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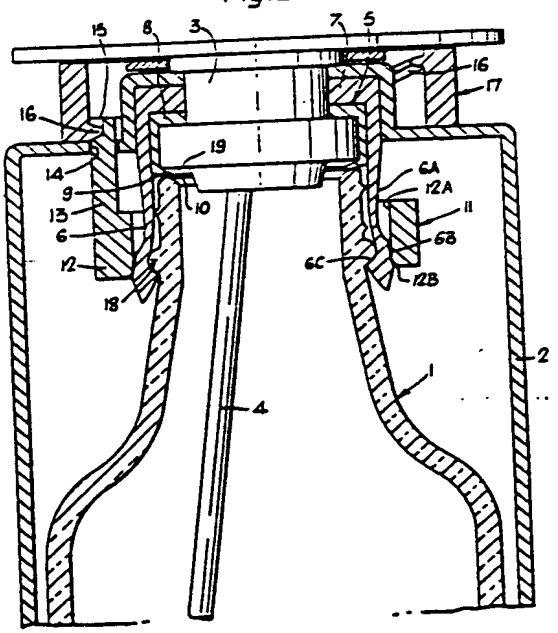
(54) **Coupling or closure assemblies**

(57) A coupling or closure assembly, for example for securing a bottle 1 into a carbonating apparatus while gas is injected through a dip tube 4 into liquid contained in the bottle. The assembly includes an annular array of claws 6 and an annular member 11 which is moveable axially relative to the claws to flex them radially inwardly and outwardly. When the claws are allowed to flex outwardly the neck of the bottle can be inserted into the space defined by the claws. When flexed inwardly the claws engage a bead 18 provided around the bottle neck to prevent withdrawal of the bottle under the action of internal gas pressure. The assembly also includes a seal 10 which engages the bottle when inserted into the assembly and which is pressed against the bottle by the action of gas pressure in a space 19 exposed to the pressure within the bottle. In other embodiments the assembly is a bottle closure *per se*, Figures 4, 5, 9 and 10 (not shown) and a pipe coupling, Figure 6 (not shown).

Fig.2.



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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

Fig. 1.

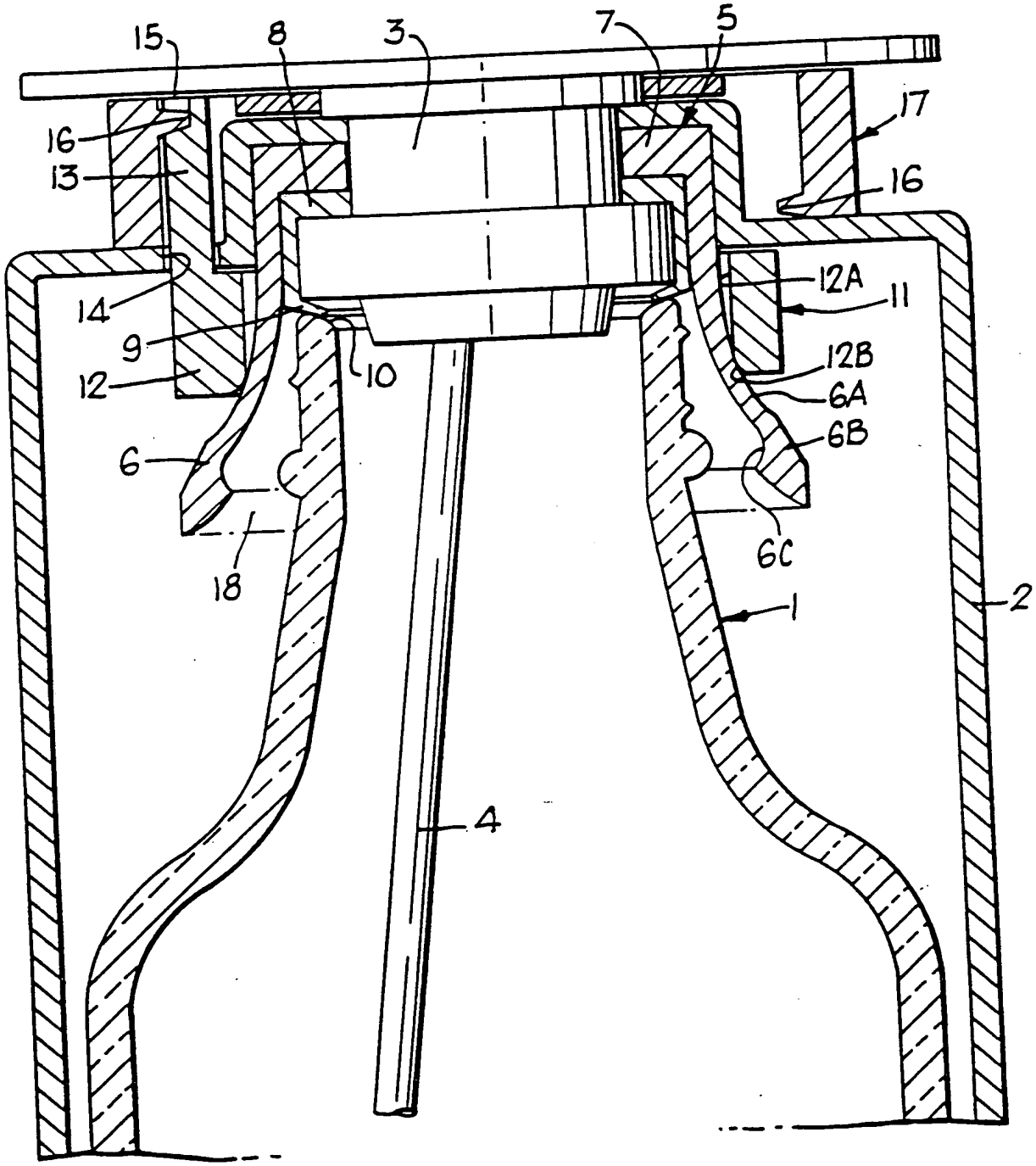


Fig. 2.

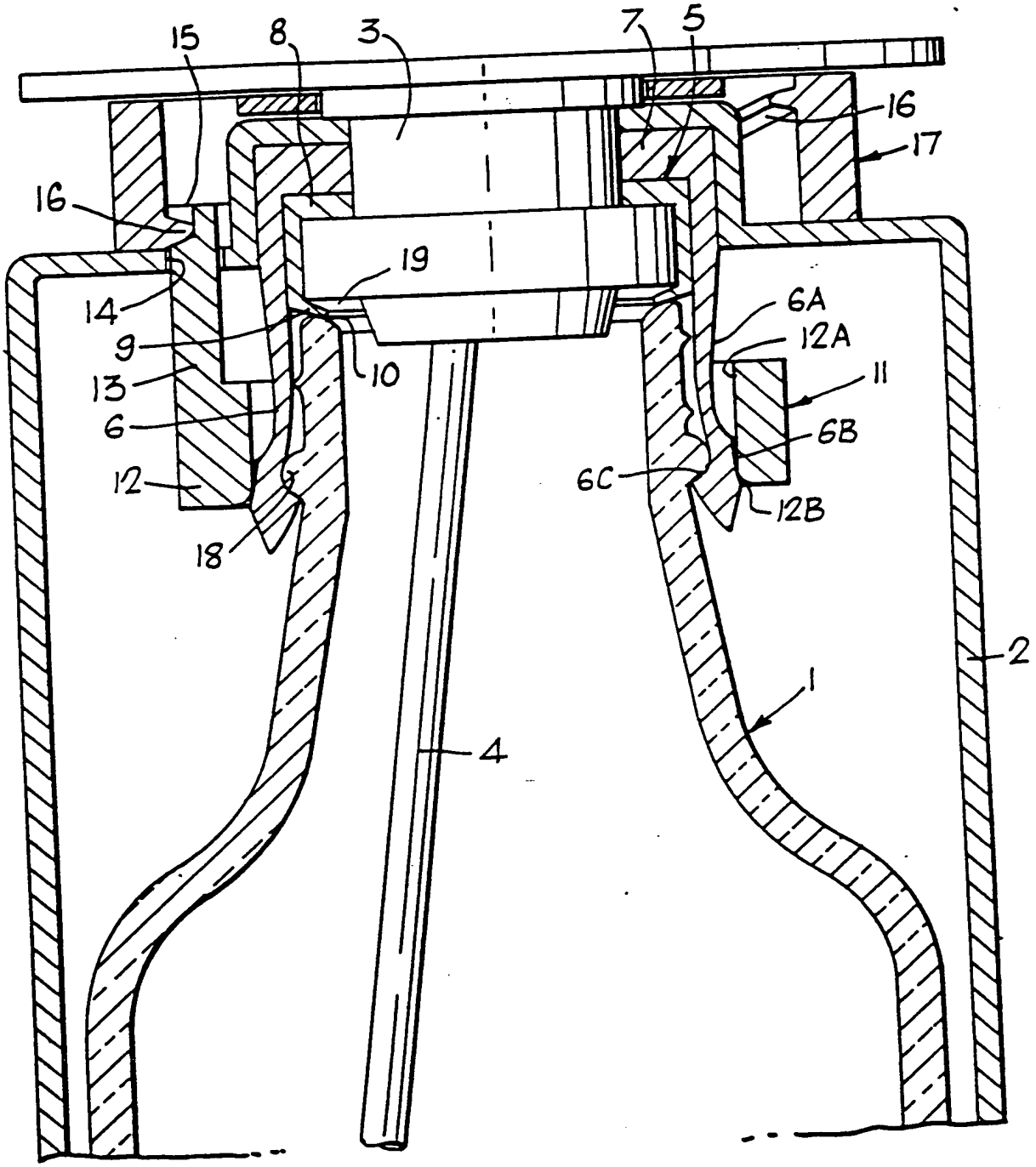


Fig. 3.

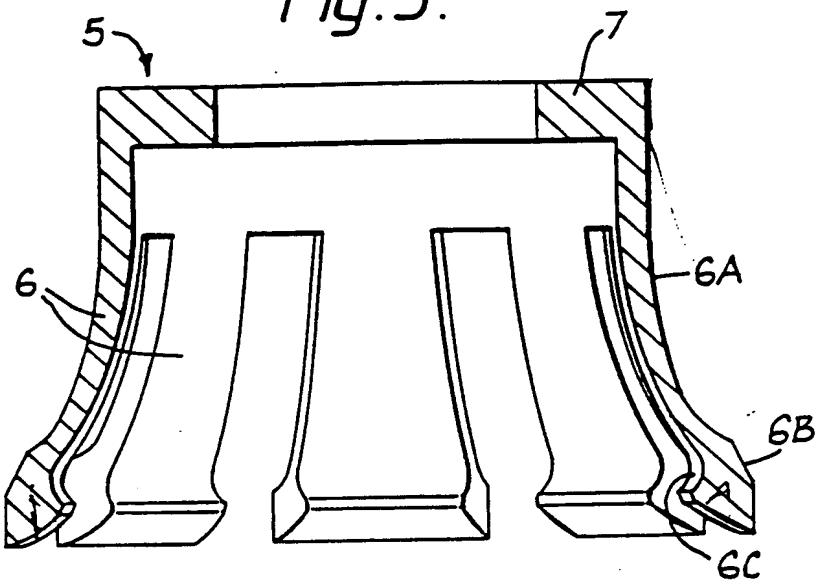


Fig. 4.

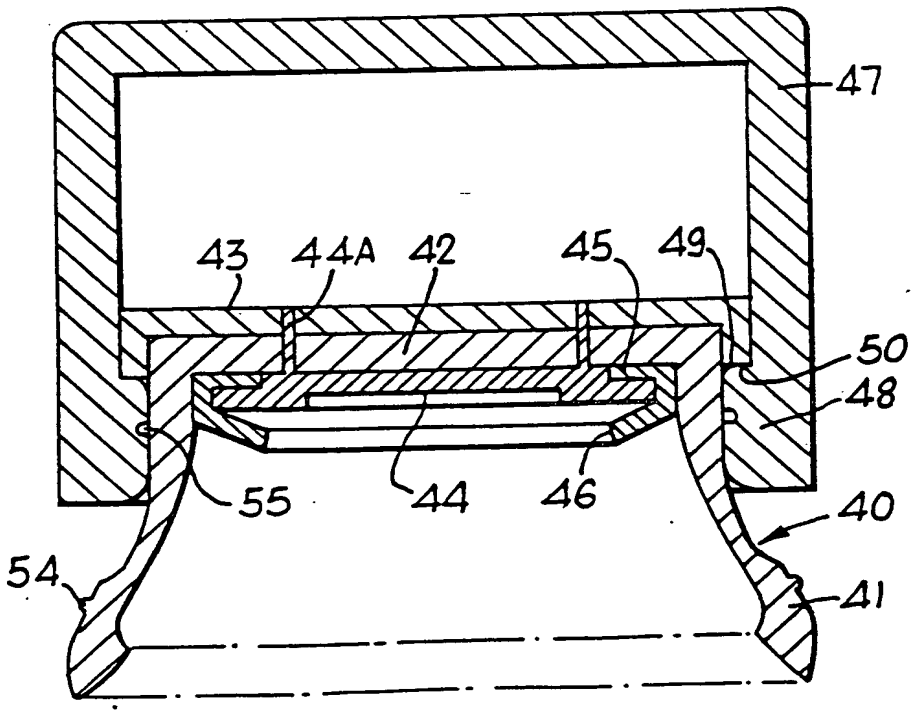


Fig. 5.

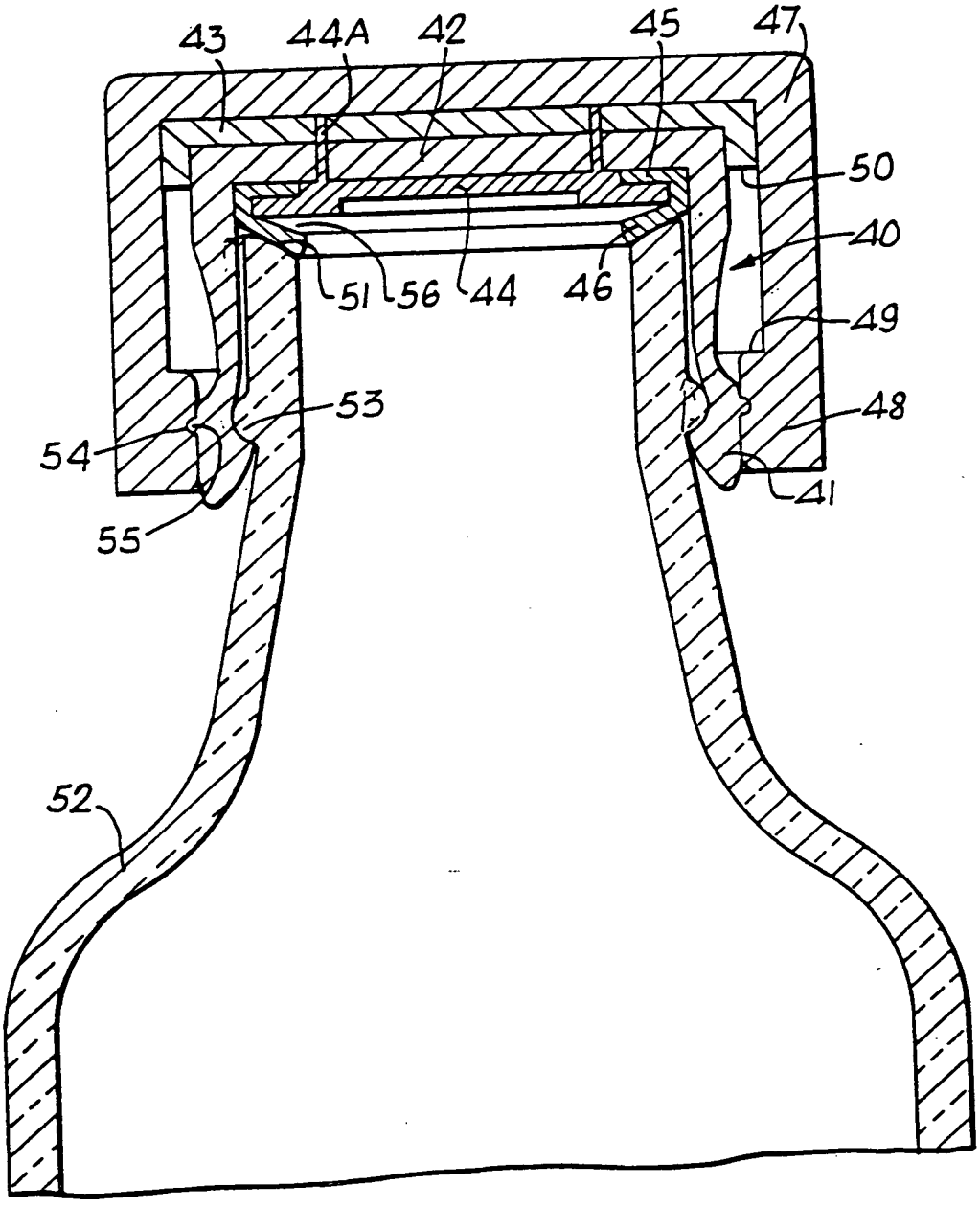


Fig.6.

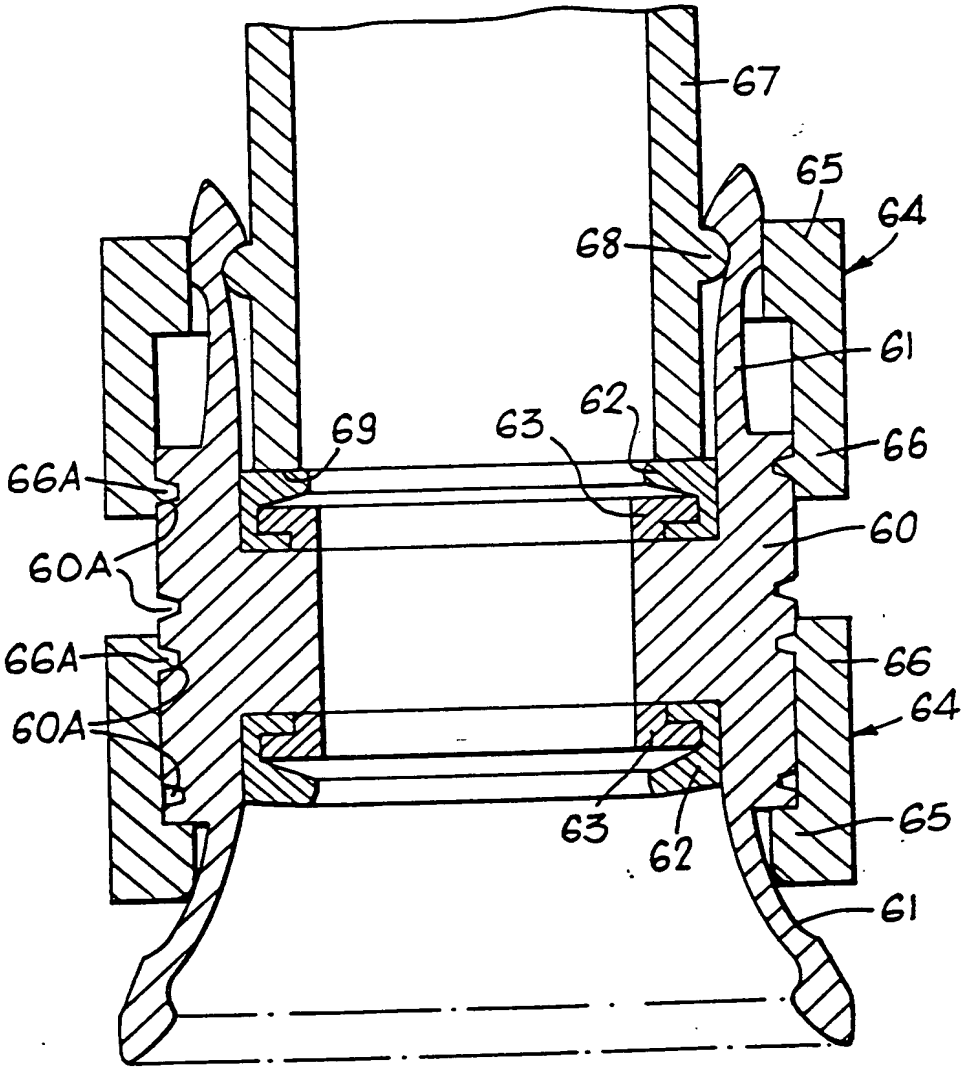
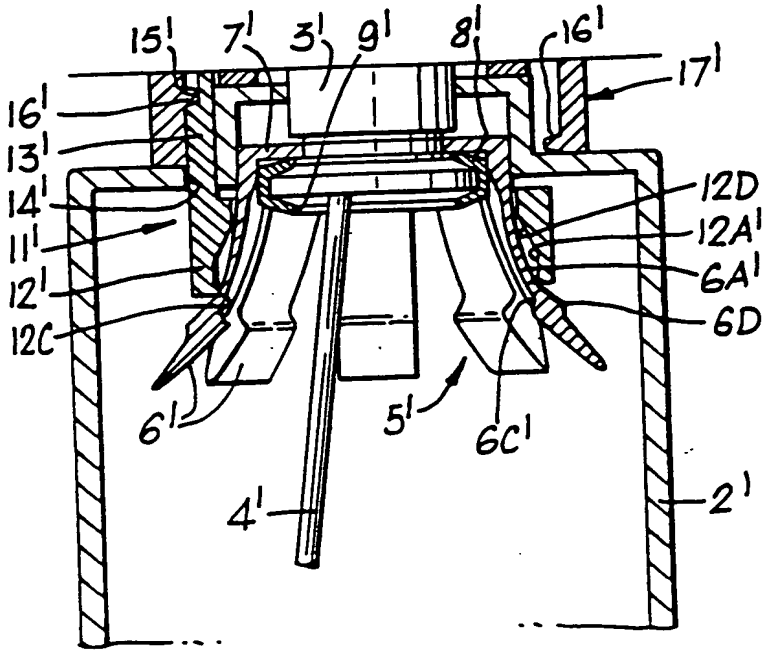


Fig. 7.


15'
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13'
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11'
12'
12C
12D
12A'
6A'
6D
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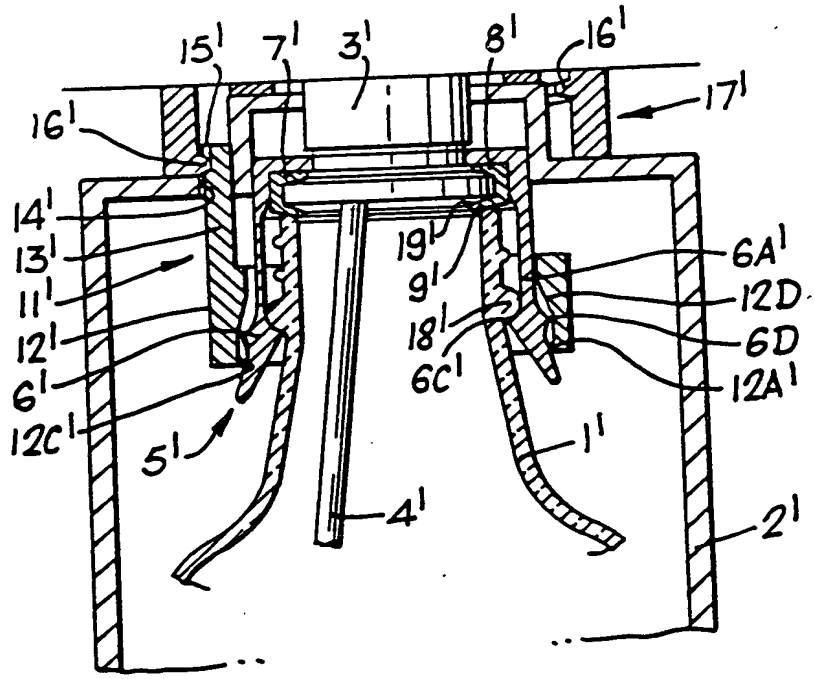
5'
6C'
4'
2'

Fig. 8.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12C'
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9'
18'
6C'
6A'
12D
6D
12A'
1'
4'
2'

Fig. 9.

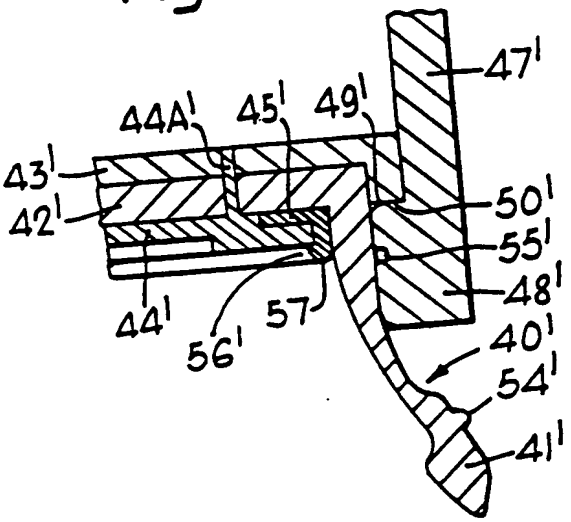
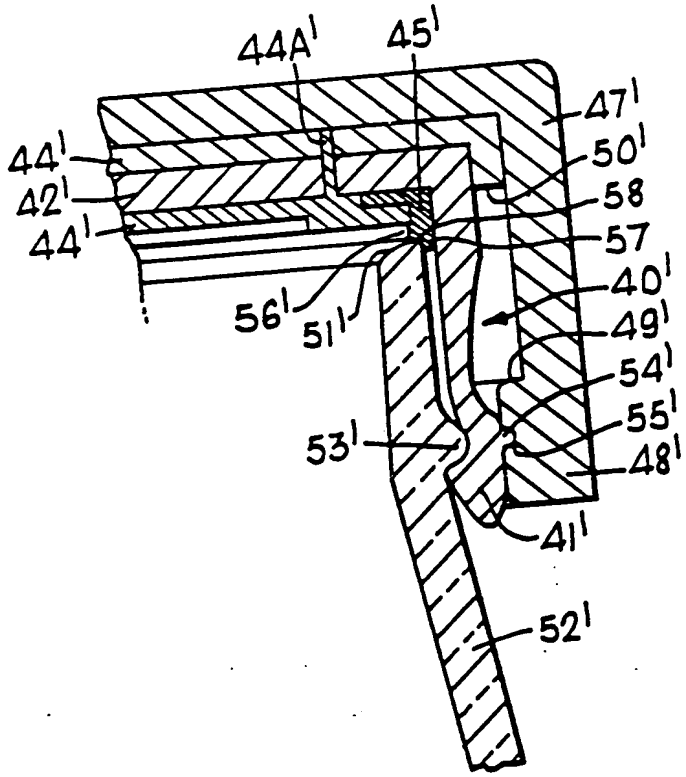

47'
44A'
45'
49'
43'
42'
50'
55'
48'
44'
56'
57
40'
54'
41'

Fig. 10.


44A'
45'
47'
44'
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53'
48'
41'
52'

SPECIFICATION

Assembly

The present invention relates to a coupling or closure assembly for securement to the open end of a tubular member.

Primarily the invention has been developed as a means of securing a bottle containing a beverage into a carbonating apparatus of the type described in our copending United Kingdom patent application No. 79 32787 during the injection of pressurised carbon dioxide gas into the beverage. In such context the invention aims at providing a coupling assembly which is simple and safe in operation, seals tighter against the bottle the higher the gas pressure, and in particular which enables the pressure loads experienced during gas injection to be met within the localised region of structure constituting the bottle neck and coupling assembly itself, rather than transmitting such loads to the frame or casing of the carbonating apparatus as has been the case with prior art devices.

It is believed, however, that the invention has utility in many other instances where it is desired to sealingly close or couple other elements to tubular members which have to withstand internal fluid pressures, such "tubular members" being e.g. necks provided on beverage bottles, brewing containers, soda syphon bodies or other pressure vessels, or simply lengths of pipe.

In accordance with the foregoing, the invention resides in a coupling or closure assembly for securement to the open end of a tubular member, comprising: means defining an annular array of claw-like elements located with respect to each other at their root ends and each such element being resiliently flexible in the radial sense about its root end; an annular member of selected internal diameter encircling said array of claw-like elements and being moveable axially with respect to said elements between a first position towards the root ends of the elements in which each such element adopts a position in which it extends both axially and radially from its root end so that the elements collectively define a generally frusto-conical envelope into and from the larger diameter end of which a tubular member of selected external diameter can be inserted and withdrawn, and a second position towards the free ends of the elements in which each such element is constrained to flex radially inwardly so as, in use, to engage with a complementary formation on a said tubular member inserted into the larger diameter end of said envelope, thereby preventing the withdrawal of such tubular member; and annular sealing means located with respect to said claw-like elements and adapted to contact a said tubular member when so inserted, said sealing means being so arranged that fluid pressure within the tubular member is effective to urge the sealing means against said tubular member.

It is to be noted that the use of such terms as "insertion" and "withdrawal" hereinabove is simply intended to indicate relative movement between the coupling or closure assembly and the tubular member such as to place the tubular member within or without the envelope defined by the claw-like elements, and does not necessarily imply that in use the coupling or closure assembly is to be held stationary while the tubular member is moved.

Similarly, although the annular member is defined to move axially with respect to the claw-like elements this is not to imply that the annular member must have a purely translational motion. For example in some embodiments of the invention the annular member may have components of movement in both the axial and rotational senses, as imparted by means of a screwthread or the like.

The nature of the invention will be more fully understood from the following particular description of preferred embodiments thereof, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a sectional view of one embodiment of the invention used as a coupling in a carbonating apparatus, in a first operative condition;

Figure 2 is a similar view of the embodiment of Figure 1 in a second operative condition;

Figure 3 illustrates more fully the claw moulding used in the embodiment of Figures 1 and 2;

Figure 4 is a sectional view of a second embodiment of the invention used as a bottle closure, in a first operative condition;

Figure 5 is a similar view of the embodiment of Figure 4 in a second operative condition;

Figure 6 is a sectional view of a third embodiment of the invention used as a pipe coupling, illustrating two operative conditions;

Figure 7 is a sectional view of a fourth embodiment of the invention again used in a carbonating apparatus, in a first operative condition;

Figure 8 is a similar view of the embodiment of Figure 7 in a second operative condition;

Figure 9 is a sectional view of part of a fifth embodiment of the invention again used as a bottle closure, in a first operative condition; and

Figure 10 is a similar view of the embodiment of Figure 9 in a second operative condition.

Referring to Figure 1, this illustrates part of a carbonating apparatus generally of the type described in our copending United Kingdom patent application No. 79 32787, which is designed to inject pressurised carbon dioxide gas into water (or other beverage) held in a bottle 1. Notably this apparatus is intended for use in the home or other small establishments for making "fizzy" drinks from mixtures of carbonated water and prepared concentrates.

In use, the bottle 1 is placed on a platform (not shown) in the apparatus and the remaining components illustrated in the figure, which are incorporated in a chassis pivoted to the portion of the apparatus which includes the above mentioned platform, are brought into the position relative to the bottle illustrated in the figure.

This apparatus includes a generally cylindrical shroud 2 of tough, impact-resistant plastics or other material which is intended to enclose the bottle 1 during gas-injection and contain the bottle fragments in the (unlikely) event of the bottle being shattered by the applied gas pressure. Borne centrally

in the shroud is a fitment 3 connectible with valve means (not shown) for the admission of gas to the bottle via a dip tube 4, and for the subsequent venting of excess pressure from the bottle.

Surrounding the fitment 3 is a plastics moulding 5 which defines an annular array of 8 equi-spaced claws 6 joined together at their root ends by an annular base part 7. This moulding is more fully illustrated in Figure 3. Also located within moulding 5 is an elastomeric sealing ring 8 having an inwardly-directed annular lip 9 which comes into contact with the end face 10 of the bottle neck when the apparatus is disposed as shown in the figure. In other embodiments the claws 6 and sealing lip 9 may be made in a single moulding.

Encircling the claws is a clamp ring 11. This element has a continuous annular skirt 12 with 3 equi-spaced projections 13 (of which one is shown in the figure) extending upwardly from the skirt through slots 14 provided for the purpose in shroud 2. Each such projection 13 has at its upper end a short part-helical groove 15 which meshes with a respective one of three longer helical formations 16 provided on the internal surface of a ring cam 17 which is borne for rotation through a limited angle externally of the shroud 2.

In the condition shown in Figure 1, which pertains initially when the bottle and coupling assembly are brought together, each of the claws 6 adopts a position in which it extends both axially and radially from its root end so that the claws collectively define a generally frusto-conical envelope the larger diameter end of which freely accommodates the terminal portion of the neck of bottle 1. By virtue of the threaded connection between clamp ring 11 and ring cam 17, however, if the ring cam is now rotated through about 90° the clamp ring is caused to descend to the position indicated in Figure 2, in so doing causing the claws 6 to flex radially inwardly about their root ends to engage the bottle neck and grip it securely in position relative to the fitment 3. More particularly, the external profile of each claw 6 includes an axially concave face 6A joining a part-cylindrical face 6B, while its internal profile includes a hook-like concave portion 6C. Interiorly the skirt 12 of clamp ring 11 has a cylindrical face 12A with a radiused edge 12B. As the ring cam 17 is rotated and the clamp ring 11 descends, edge 12B of the latter rides down the faces 6A of the claws flexing the claws inwardly against the bottle neck, with further movement the respective faces 12A and 6B of the clamp ring and claws coming into register to complete and maintain the gripping action. In this condition, shown in Figure 2, the concave portion 6C of each claw has closed around and under an annular bead 18 provided around the bottle neck, this action tending to lift the bottle slightly against the sealing lip 9.

In use of the apparatus, gas injection can now take place. By operation of valve means (not shown) carbon dioxide gas is admitted from a cylinder (not shown) housed in another part of the apparatus through dip tube 4 to the water in bottle 1. The pressure reached within the bottle at this time may typically be in the region of 100-150 psi, the injection pressure being limited by a relief valve (not shown) in the fitment 3. With this relatively high pressure existing within the bottle 1, it will be appreciated that the tendency is for the bottle to pull away from the fitment 3. The tendency is checked, however, by the engagement of the claws 6 around the bead 18 of the bottle neck. In turn, the tendency is thus for the claws 6 to be pressed radially outwards by the downward-pulling bead 18, but this is prevented by the encircling skirt of the clamp ring 11. In this way, the pressure loads set up by the gas injection process are met within the localised region of structure constituting the bottle neck and coupling assembly, and no substantial loads need be transmitted through the base of the bottle to the casing or frame of the carbonating apparatus.

At the same time, the relatively high pressure within the bottle is transmitted to the annular space 19 which exists between the fitment 3 and sealing lip 9, urging the lip into tight sealing engagement with the end face 10 of the bottle.

At the end of gas injection, a valve (not shown) is opened to vent excess pressure from the bottle, and ring cam 17 is then rotated back into the position shown in Figure 1. This raises the clamp ring 11, allowing the claws 6 to resile outwardly and disengage from the bottle neck. The aforementioned chassis can then be pivoted upwards allowing the bottle of carbonated water to be removed.

Turning now to Figure 4 this shows a second embodiment of the invention in the form of a closure assembly e.g. for a bottle of ready-made carbonated beverage or the like pressure vessel. This comprises a claw moulding 40 which defines an annular array of equi-spaced claws 41 generally similar to the claws 6 described above (and only two of which are shown in Figure 4), joined together at their root ends by an integral disk-shaped base part 42. The base part of the claw moulding is held between two rigid plastics members 43 and 44 and the whole assembly is secured together in any convenient manner, such as by staking member 44 through to member 43 as indicated at 44A. Retained between moulding 40 and member 44 is an elastomeric sealing ring 45 having an inwardly-directed annular lip 46. Completing the assembly is a cup-shaped cap 47 having a thickened ring 48, which can be slid relative to the other components of the assembly from the position indicated in Figure 4 to the position indicated in Figure 5.

In the position indicated in Figure 4, the cap 47 is in its upper position and is prevented from detaching from the other components by the abutment of opposing shoulders 49 and 50 on the rim of the cap and the member 43. It is also retained in place by the friction between its rim 48 and the outer surfaces of the claws 41 which have a natural tendency to spring outwards against the rim of the cap. In this condition, each of the claws 41 is permitted to adopt a position in which it extends both axially and radially from its root end so that the claws collectively define a generally frusto-conical envelope the larger diameter end of which can accommodate the terminal portion of the neck of a bottle, just as in the embodiment of Figure 1.

In order to close a bottle, the assembly is taken in this position and placed axially over the end of the bottle until the sealing lip 46 comes into contact with the end face 51 of the bottle 52 as shown in Figure 5. Now, the cap is pushed down so that the seal is compressed against the bottle and the rim of the cap slides down along the external profile of the claws 41, in so doing causing the claws to flex radially inwards about their root ends to engage around and under an annular bead 53 provided around the bottle neck, thereby gripping the closure to the bottle 52 in exactly the same manner as the coupling of Figures 1 and 2 is gripped to its bottle.

As before, the tendency of internal pressure to separate the bottle and closure by flexing the claws 40 outwardly is resisted by the encircling member constituted in this case by the cap rim 48. In order to prevent the inadvertent withdrawal of the rim from the locking position shown in Figure 5, pips may be moulded onto the outer part-cylindrical surfaces of the claws as shown at 54, to engage in an annular recess 55 provided in the cap rim. At the same time, the fluid pressure in the bottle is transmitted to the annular space 56 between the member 44 and sealing lip 46 to urge the latter tightly against the end face 51 of the bottle.

To remove the closure the cap 47 is pulled upwards to disengage the pips and recess 54 and 55 and permit the cap to rise towards its position shown in Figure 4. In so doing the claws 41 are allowed to resile and disengage from the bottle neck so that the whole assembly can be pulled away from the bottle. It will be appreciated that with an assembly of the type shown in Figures 4 and 5 closure and opening of the bottle are each achieved in a single axial movement. There is thus provided an easy to use "push on/pull off" assembly which, despite its simplicity of operation, provides a secure and fluid-tight closure.

Figure 6 of the accompanying drawings shown an application of the invention to the coupling together of lengths of pipe. In this embodiment there is a double ended claw moulding 60, each end of which presents an array of claws 61 similar to those described above. Each half of the claw moulding has an associated annular lip seal 62, again generally as before, with a seal retainer 63.

Encircling the claw moulding are a pair of clamp rings 64, one for each end. Each such element has an annular skirt 65 and a cylindrical portion 66 provided with a series of inwardly-directed projections 66A which locate in complementary part-helical grooves 60A formed in the claw moulding 60. This relationship is such that each clamp ring can be turned independently through a limited angle relative to the claw moulding and other components of the assembly, in so doing the clamp ring also being constrained to move axially. The limiting axial positions of the rings are indicated respectively by the upper and lower rings in Figure 6.

As will be appreciated, by moving the clamp rings in this way they cause the associated claws 61 to flex inwardly and outwardly in the same manner as for the previously described embodiments so that, in the position indicated in the lower half of Figure 6, the terminal portion of a pipe length can be inserted into and withdrawn from the coupling, while in the position indicated in the upper half of Figure 6 a pipe length 67 can be securely gripped to the coupling by virtue of the engagement of the respective claws with a bead 68 provided around the terminal portion of the pipe, and sealed by virtue of the contact between the respective lip seal 62 and the end face 69 of the pipe.

The action of the coupling in resisting separation of the coupled pipe lengths is the same as for the earlier-described embodiments, as is the tendency of internal fluid pressure to reinforce the sealing contact between seals 62 and the adjacent pipe ends.

Figures 7 and 8 illustrate yet another embodiment of the invention, once again as applied to a carbonating apparatus of the type described in relation to Figures 1 and 2. The assembly shown in Figures 7 and 8 is basically similar to that of Figures 1 and 2, and like reference numerals with the addition of a prime are used to indicate corresponding components. The major difference is in the configuration of, and interaction between, the claws 6' and clamp ring 11'. The external profile of each claw includes an axially concave face 6A' and its internal profile includes a hook-like concave portion 6C', as before, but in place of the part-cylindrical external face 6B the earlier-described claw there is a protruding shoulder 6D. At the same time the skirt 12' of clamp ring 11' has an internal cylindrical face 12A' as before, but in this case it terminates not with the radiused edge 12B but with an inwardly extending lip 12C defining an "entrance" to the clamp ring of smaller diameter than the adjacent cylindrical portion 12A'. Additionally, to accommodate the larger-diameter claw shoulders 6D when the assembly is in the bottle-clamping condition shown in Figure 8, the skirt portion 12A' of the clamp ring is placed at the end of a frusto-conical portion 12D.

Referring to Figure 8, the use of the assembly to grip a bottle 1' into the carbonating apparatus is the same as before. That is to say the ring cam 17' is rotated to cause the clamp ring 11' to descend and flex the claws radially inwardly about their root ends until the concave portion 6C' of each claw has closed around and under an annular bead 18' provided around the bottle neck. In this case, however, as the clamp ring descends its terminal lip 12C snaps past the claw shoulders 6D, the claws thereafter being held in their bottle-gripping position by the abutment of the shoulders 6D with the clamp ring surface 12A', in what is effectively a recess defined between the lip 12C and frusto-conical surface 12D. In this condition the lip 12C acts as a detent to resist any possible tendency for the shoulders 6D to disengage from the clamp ring and drive the latter upwards, until such time as this is effected by the user rotating the ring cam 17'.

A suitably modified arrangement of this type may equally be applied to the embodiments of Figures 4 to 6 described above.

In all examples of the invention so far described, a gas-tight seal is effected between the respective sealing lip 9, 46, 62 or 9' and at least a major portion of the radial width of the end face 10, 51, 69 or 10' of

the respective "tubular member". Although this is generally the preferred arrangement, it is within the purview of the invention for the seal to be effected at any or all points along the width of the end face from its internal to its external edge, and/or at the internal or external circumferential faces of the opening of the "tubular member". Purely by way of example, Figures 9 and 10 illustrate an embodiment in which a seal is effected predominently at the external edge of the end face. This is shown as applied to a bottle closure of the type described with reference to Figures 4 and 5, like reference numerals with the addition of a prime being used to indicate corresponding components. However, such a seal arrangement may equally be applied to the other embodiments of the invention described above.

Referring to Figure 9, the seal 45' in this case is seen to comprise a rounded body part 57 in place of the lip 46 shown in Figure 4. When the closure is applied to a bottle 52', as shown in Figure 10, the seal comes into contact with the end face 51' of the bottle. Fluid pressure in the cavity 56' defined between the member 44' and face 51' compresses the material in the body part 57 of the seal against the claw moulding 40', causing the seal material to flow around, and press tightly against, the external edge 58 of the face 51'.

CLAIMS

1. A coupling or closure assembly for securement to the open end of a tubular member, comprising: means defining an annular array of claw-like elements located with respect to each other at their root ends and each such element being resiliently flexible in the radial sense about its root end; an annular member of selected internal diameter encircling said array of claw-like elements and being movable axially with respect to said elements between a first position towards the root ends of the elements in which each such element adopts a position in which it extends both axially and radially from its root end so that the elements collectively define a generally frusto-conical envelope into and from the larger diameter end of which a tubular member of selected external diameter can be inserted and withdrawn, and a second position towards the free ends of the elements in which each such element is constrained to flex radially inwardly so as, in use, to engage with a complementary formation on a said tubular member inserted into the larger diameter end of said envelope, thereby preventing the withdrawal of such tubular member; and annular sealing means located with respect to said claw-like elements and adapted to contact a said tubular member when so inserted, said sealing means being so arraged that fluid pressure within the tubular member is effective to urge the sealing means against said tubular member.

2. An assembly according to claim 1 wherein said annular member has a cylindrical internal surface and said claw-like elements have respective part-cylindrical external surfaces complementary to said cylindrical internal surface of the annular member, said complementary surfaces coming into register when the annular member is disposed in its second said position.

3. An assembly according to claim 1 or claim 2 wherein said claw-like elements have respective protrusions upon their external surfaces each of which enters a complementary formation in the internal surface of the annular member when the latter is disposed in its second said position, thereby to resist disengagement of said elements and member.

4. An assembly according to claim 1 wherein said annular member has a cylindrical internal surface terminating, at one end of said surface towards the free ends of the claw-like elements, with an inwardly extending lip; and said claw-like elements have respective protrusions upon their external surfaces each of which comes into register with a portion of said cylindrical internal surface when the annular member is disposed in its second said position.

5. An assembly according to any preceding claim wherein said annular sealing means present an inwardly extending lip which is adapted to contact the end face of a tubular member when inserted as aforesaid, a space exposed to the fluid pressure within the tubular member being defined on the side of said lip opposite to that side which contacts the tubular member.

6. An assembly according to any one of claims 1 to 4 wherein said annular sealing means include a portion which is adapted to contact the external edge of the end face of a tubular member when inserted as aforesaid, a radially inwardly facing surface of said portion being exposed to the fluid pressure within the tubular member and said portion being surrounded by an effectively rigid member against which it is adapted to be compressed by such pressure.

7. An assembly according to any preceding claim wherein said annular member is constrained to move purely translationally relative to the claw-like elements and is operatively connected with a rotatable member in a screw-threaded manner such that by rotation of said rotatable member the annular member is caused to move between said first and second positions.

8. An assembly according to any one of claims 1 to 6 wherein said annular member is operatively connected in a screw-threaded manner with a co-operating member rigid with, or constituting, said means defining the array of claw-like elements, such that by rotating the annular member relative to said co-operating member it is caused to move between said first and second positions.

9. A coupling or closure assembly for securement to the open end of a tubular member substantially as hereinbefore described with reference to Figures 1 to 3, Figures 4 and 5, Figure 6, Figure 7 and 8 or Figures 9 and 10 of the accompanying drawings.

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